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द्रवित पेट्रोलियम गैसेस — विशिष्टि

(चौथा पुनरीक्षण)

Liquefied Petroleum Gases — Specification

(Fourth Revision)

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February 2021 **Price Group 3**

Petroleum and their Related Products of Synthesis or Biological Origin Sectional Committee, PCD 03

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Petroleum and Their Related Products of Synthesis or Biological Origin Sectional Committee was approved by the Petroleum, Coal and Related Products Division Council.

This standard was first published in 1968 and subsequently revised in 1978, 1999 and 2018. In the first revision, in order to restrict the production of LPG for present as well as for future refineries to a maximum vapour pressure, which is the design pressure of the existing LPG cylinders produced in the country, the vapour pressure of commercial butane-propane mixture had been changed to 16.87 kgf/cm^2, *Max* at 65°C from its present range of 10 to 20 kgf/cm^2. In the second revision characteristics for composition were included and residue on evaporation was deleted. Requirement for total volatile sulphur, hydrogen sulphide were changed. Dryness was replaced by free water content. Based on ISO 9162 : 1989, requirements for vapour pressure was changed to 520, 1 050 and 1 550 kPa, *Max* at 40°C, respectively for butane, butane-propane mixture and propane.

In the third revision, requirements for density, moisture content and caustic content were included. Total volatile sulphur was reduced from 150 to 140 ppm.

Taking into consideration the views of producers and suppliers of liquefied petroleum gases in the country, fuel technologies and the interest of consumers, the Committee decided to relate this standard to the manufacturing practices followed in the country.

In this fourth revision, test method for caustic has been modified, replacing phenolphthalein indicator with alizarin yellow. Test temperature of copper strip corrosion test is changed from 38 to 40°C, in line with test method. Moisture content (dryness test) note below table 1, has also been corrected.

Keeping in view the need for international coordination among the principal standards in this field, assistance has been derived from the following standards:

ISO 9162 : 2013(E)	Petroleum products — Fuels (class F) — Liquefied petroleum gases — Specification
ASTM D1835-2020	Standard Specification for liquefied petroleum (LP) gases
GPA Standard 2140-2017	Liquefied Petroleum Gas Specifications and Test Methods

The following alternate test methods are also available for the characteristics stated and in case of dispute the corresponding part of IS 1448 as given in Table 1 shall be the referee test method.

Characteristic	Methods of Test
Density	ASTM D1657
Vapour pressure	ASTM D1267 / D6897
Composition	ASTM D2163
Sulphur	ASTM D3246/ D7551 / D7994
Hydrogen sulphide	ASTM D2420
Moisture content	ASTM D2713
Free water content	ASTM D1657

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LIQUEFIED PETROLEUM GASES — SPECIFICATION

(Fourth Revision)

1 SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for all types of liquefied petroleum gases commercially marked for household, commercial, and industrial applications excluding automotive use in the country.

1.2 This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCES

The following Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision and parties to agreements based on this standard are advised to use the latest editions of the standards indicated below:

IS No.	*Title*
1260 (Part 1) : 1973	Pictorial marking for handling and labelling of goods: Part 1 Dangerous goods (*first revision*)
1447 (Part 2) : 2013/ ISO 4257 : 2001	Methods of sampling of petroleum and its products: Part 2 Sampling of liquefied petroleum gases (LPG) (*second revision*)
1448	Methods of test for petroleum and its products
[P : 70] : 2018	Determination of residue in liquefied petroleum gases (*first revision*)
[P : 71] : 2004/ ISO 4256 : 1996	Part 71 Liquefied petroleum gases — Determination of gauge vapour pressure — LPG method
[P : 72] : 1968	Part 72 Volatility of liquefied petroleum gases
[P : 73] : 2004/ ISO 8819 : 1993	Part 73 Liquifiable petroleum gases — Detection of hydrogen sulphide — Lead aetate method (*first revision*)
[P : 76] : 2019/ ISO 3993 : 1984	Part 76 Liquified petroleum gases and light hydrocarbons — Determination of density or relative density — Pressure hydrometer method (*first revision*)
[P : 151] : 2004/ ISO 7941:1998	Part 151 Commercial propane and butane — Analysis by gas chromatography
[P : 152] : 2004/ ISO 6251 : 1996	Part 152 Liquefied petroleum gases — Corrosiveness to copper — Copper strip test
3196 (Part 1) : 2013	Welded low carbon steel cylinders exceeding 5 litre water capacity for low pressure liquefiable gases: Part 1 Cylinders for liquefied petroleum gases (LPG) (*sixth revision*)
2825 : 1969	Code for unfired pressure vessels

3 TERMINOLOGY

For the purpose of this standard, the following definition shall apply.

3.1 Liquefied Petroleum Gas (LP Gas or LPG) — The term applies to a mixture of certain light hydrocarbons derived from petroleum which are gaseous at normal ambient temperature and atmospheric pressure but may be condensed to the liquid state at normal ambient temperature by the application of moderate pressure.

3.1.1 LP gases mainly consist of one or more of the following hydrocarbons:

a) Propane (C_3H_8);
b) Propylene (C_3H_6);

c) n-butane (C_4H_{10});
d) Iso-butane (C_4H_{10}); and
e) Butylene (C_4H_8).

3.1.2 Small quantities of one or more of the following hydrocarbons may also be present:

a) Ethane (C_2H_6);
b) Ethylene (C_2H_4);
c) Pentane (C_5H_{12}); and
d) Pentene (C_5H_{10}).

4 TYPES

4.1 This standard specifies three types of LP gases, based on their principal constituent(s):

a) *Commercial Butane* — A hydrocarbon product composed predominantly of butanes, butylene or their mixtures.
b) *Commercial Butane-Propane Mixture* — A hydrocarbon product composed predominantly of a mixture of butanes and/or butylene with propane and/or propylene
c) *Commercial Propane* — A hydrocarbon product composed predominantly of propane, propylene or their mixtures.

5 REQUIREMENTS

5.1 The material shall comply with the requirements given in Table 1 when tested according to appropriate methods given in col. 6 of Table 1.

5.2 LPG shall contain a minimum quantity of odourant, generally a mercaptan, to detect a leak. Adequate odour shall be observed, when tested as mentioned below.

5.2.1 To detect the odour, the following procedures may be adopted:

a) 5 ml Doctor solution + 8 ml Iso-octane + Pinch of Sulphur powder in 25 ml stoppered cylinder. Shake and add 2 ml LPG (liq). Shake slowly by releasing pressure.
b) Odour is adequate if Sulphur turns yellowish brown.

5.3 Residue of LPG

Subject to agreement between the purchaser and the supplier, the material shall also pass the agreed limits of residue when tested according to IS 1448 (Part 70).

6 PACKING AND MARKING

6.1 Packing

The material shall be packed in suitable cylinders/containers as agreed to between the purchaser and the supplier and subject to the requirements prescribed by statutory authorities. (For cylinders, *see* IS 3196 and for comments, *see* IS 2825).

6.2 Marking

The cylinders/containers shall be marked as prescribed by statutory authorities from time to time. They shall bear the labels marked with the following information:

a) Name and type of the material;
b) Mass in kg of the material in the container;
c) Maximum vapor pressure in case of commercial butane-propane mixture only; and
d) Manufacturer's name and trade-mark, if any.

6.2.1 Each cylinder/container shall also be marked with the caution label 'FLAMMABLE' together with the corresponding symbol for labeling dangerous goods [Fig. 18 of IS 1260 (Part 1)].

6.2.2 *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

7 SAMPLING

7.1 Representative samples of liquefied petroleum gas shall be drawn as prescribed in IS 1447 (Part 2).

7.2 Tests on vapor pressure shall be conducted on individual samples and the rest of the tests shall be conducted on composite samples.

Table 1 Requirement for Liquefied Petroleum Gases

(*Clause* 5.1)

Sl No.	**Characteristics**	**Requirement for Commercial**			**Method of Test, Ref to [P] of IS 1448/ISO**
		Butane	Butane-Propane mixture	Propane	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Density[1)] at 15°C, kg/m^3	Report	Report	Report	[P : 76]
ii)	Vapour pressure[2)] at 40°C, kPa, gauge, *Max*	520	1050[3)]	1550	[P : 71]
iii)	Composition, liquid volume percentage[4)]				[P : 151]
	a) C$_2$ hydrocarbons	—	Report	Report	
	b) C$_3$ hydrocarbons	Report	Report	95.0 Min	
	c) C$_4$ hydrocarbons	Report	Report	4.0 Max	
	d) C$_5$ hydrocarbons and heavier , *Max*	2.5	2.5	0.2 Max	
	OR				
	Volatility:				[P : 72]
	Evaporation temperature in °C for 95percent by volume at760 mm Hg Pressure, *Max*	2.2	2.2	-38.0	
iv)	Total volatile Sulphur[5)], mg/kg (ppmw), *Max,*	140	140	150	D6667
v)	Copper strip corrosion at 40°C for 1 hour		Not worse than No 1		[P : 152]
vi)	Hydrogen sulphide[6)]	Pass	Pass	Pass	[P : 73]
vii)	Moisture content (Dryness Test)[7)]	—	—	Pass	ISO 13758
viii)	Free water content[8), 9)]	None	None	—	[P : 76] [10)]/ Visual
ix)	Caustic test	Pass	Pass	Pass	Note 11

NOTES:

1 Density/relative density may also be determined by analyzing the gas by gas chromatograph and using composition and density factor data as per ISO 8973/IP 432.

2 Vapour pressure may be determined at any other temperature and converted to 40°C/65°C by means of suitable vapour pressure-temperature graph. The same can also be determined by analyzing the gas by gas chromatograph and using composition and vapour pressure data as per ISO 8973/IP 432.

3 Each consignment of commercial butane-propane mixture shall be designated by its maximum vapour pressure in kPa at 40°C and shall not exceed 16.87 kg/sq. cm at 65ºC for transportation through road tank trucks.

Further, if purchaser and the supplier agreed, the minimum vapour pressure of that mixture shall not be lower than 200 kPa gauge compared to the designated maximum vapour pressures and in any case the minimum for the mixture shall be not lower than 520 kPa at 40°C.

4 Molar composition of LPG determined by gas chromatographic analysis can be converted into liquid-volume using the standard practice as per ASTM D2421. Composition by IS 1448 [P : 151] or any other equivalent GC method like ASTM D2163 may be used in case of dispute.

5 Total volatile sulphur limit include sulphur compounds added intentionally as odourant /for odouring purposes.

6 'Pass' the test indicates hydrogen sulphide not more than 5ppm. Hydrogen sulphide can also be determined with the following procedure: Take 5 ml of lead acetate solution (prepared in IPA) + 25 ml LPG (liquid) in measuring cylinder and shake well. If black precipitation is not seen then H$_2$S test passes.

7 The dryness test is applicable to only propane & not butane/butane-propane mixture. Dryness is important in relation to freezing in pressure reducing regulators.

8 Free water test only applies to butane/butane-propane mixture. Water promotes rust on internal surface of steel storage tanks and iron piping system systems. Water can also cause odourant fade and can block small openings. LPG can not contain any free water at 0°C and shall be determined by visual inspection of sample using equipment on which density is determined. Subject to agreement between purchaser and supplier, limit, temperature and method for water content determination may be changed for specific applications like shipment of refrigerated LPG etc.

9 Free water content can also be determined with the following procedure:

Take 100 ml of liquid in dry graduated tube and allow to vaporize the LPG. When about 2-3 ml residue is left, shake and pour the residue on wattman filter paper. Allow the residue on filter paper to evaporate; if wet spot not seen, free water is absent.

10 In case of dispute, this method shall be the referee method.

11 For caustic test following procedure may be adopted:

> 2 ml LPG (liq) + 5 ml demineralised water in a weathering tube, add a drop of Alizarin Yellow R indicator (Mordant Orange-1, 5-(4-Nitrophenylazo) Salicylic acid, Dye content 70 percent, CAS no 2243-76-7). Caustic test is pass, if it doesn't turns into *red* from *yellow.*

Preparation of indicator: Take 0.1 gm in 100ml volumetric flask and dissolve it in demineralised water then make up to the mark with demineralised water.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Petroleum and their Related Products of Synthesis or Biological Origin Sectional Committee, PCD 03

Organization	*Representative(s)*
In Personal Capacity	Dr L. M. Das (***Chairman***)
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Hero Motocorp Ltd, Gurugram	Shri Feroz Ali Khan Shri Pawan Kumar (*Alternate*)
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Organization	*Representative(s)*
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Member Secretary

Shrimati Nagamani T.
Scientist ‘E’ (BIS)

Gaseous Fuels Subcommittee, PCD 3 : 5

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